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Project Summary

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Air Pollution Impacts when Quenching Blast Furnace Slag with Contaminated Water

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A potential alternative to treatment prior to discharge of coke plant waste waters is to use it, untreated, to quench blast furnace slag. The question arises, will this result in a significant increase in emissions to the atmosphere? To develop preliminary answers to this question, six emission measurements were made on a laboratory-scale facility simulating typical slag quenching practice. Test parameters encompassed two slag temperatures (594 and 816°C) and two waters, ASTM Type 1 water and coke plant effluent diluted to 2500 mg/l TDS. The results indicate that particulate emissions increase with slag temperature and TDS in the water. Minor quantities of organic compounds were emitted but showed no correlation with test variables. The data also showed no correlation between emissions of sulfur dioxide or fluoride and test variables.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

This report describes the results of an experiment conducted to evaluate the impact of atmospheric emissions from quenching blast furnace (BF) slag with contaminated water. This work is a continuation of similar work reported in EPA-600/2-84-072 (NTIS PB84-172493) in March 1984. The work involved an assessment of atmospheric emissions from quenching of BF slag with BF blowdown water.

This study involved a laboratory scale assessment of simulated slag quenching in a specially designed pot partially filled with fresh molten slag, reheated in a propane-fired furnace, and quenched with BF blowdown water. This study revealed a direct relationship between the content of total dissolved solids (TDS) in the quench water and the resultant level of particulate emissions. A direct relationship was also found between the slag temperature and particulate emission rates. Based on the limited data obtained in this work, no correlation could be drawn between slag temperature or level of specific contaminants in the quench water and the resulting air emissions of that contaminant. The purpose of the current assignment was to expand the data base by measuring atmos-pheric emissions during BF slag quenching with very clean water and with contaminated water. Laboratory scale equipment assembled for the previous study was used in this study.

Slag was poured into the slag pots at the BF and transported to the experimental furnace. Blowdown water was obtained from another BF with a moderately tight recycle system and transported to the laboratory in 5-gal. (18.9 liter) jars. Coke plant wastewater obtained from a coke plant was diluted to ≅2500 mg/liter of TDS and used for quenching. ASTM Type I water with low TDS and no organics was used as a baseline for comparison. Six test runs were conducted at two different ranges of slag temperature. These tests provided a qualitative estimate of emissions under different slag temperatures and the effect of the use of different types of water on these emissions.

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Conclusions

Major findings and conclusions of the study included:

1. Particulate emissions, measured by the front half of the modified SASS train during BF slag quenching, increase with increasing slag temperature. The higher the TDS in the quench water, the more pronounced the increase becomes.
   The estimated regression line equations for low and high slag temperature quench are:
   $$y = 53.5 + 0.0495\ x$$
   (for low temperature ≅ 594 °C)
   $$y = 30.38 + 0.14779\ x$$
   (for high temperature ≅ 816 °C)
   where, x is the TDS content of the quench water and y is the particulate emissions (mg/liter of quench water evaporated).
2. *Based on this laboratory-scale simulation, for coke plant wastewater containing a comparable TDS content as that of BF blowdown water, the emissions generated during slag quenching at high temperature are considerably less using coke plant water than when using BF blowdown water. The pollutants present in the coke plant water appear to break down at high-temperature slag quenching and result in less particulate emissions.*
3. *Emissions of metals increase with high-temperature slag quenching.*
4. *No specific relationship was found between organic pollutants and the use of ASTM type I water or BF blowdown water, and slag temperature during quenching.*
   Significant amounts of priority pollutants were dissociated from the coke plant wastewater at both low- and high-temperature slag quenching, when all the applied water was evaporated.
5. *No correlation was found between quench water quality, slag temperature, or slag sulfur content and emissions of sulfur dioxide.*
6. *Chloride emissions are higher at high-temperature slag quench. The emissions are higher if the quench water contains higher chloride concentration.*
7. *Cyanides appear to dissociate at both low- and high-temperature slag quenching with BF blowdown water.*
8. *Ammonia appears to break down at higher-temperature quenching. The ammonia emissions are higher if the quench water contains higher ammonia concentrations.*
9. *Fluoride emissions are higher at higher-temperature slag quenching and they bear no relationship to the quench water quality.*

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The complete report, entitled "Air Pollution Impacts when Quenching Blast Furnace Slag with Contaminated Water," (Order No. PB 87-100 533/AS; Cost: $11.95, subject to change) will be available only from:
National Technical Information Service
5285 Port Royal Road
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